

TITLE: TRANSFER OF TOXINS THROUGH THE FOODWEB

MILESTONE SHC 2.5.1: Provide one forecast on the occurrence, distribution, and frequency of a harmful algal bloom in the U.S. and develop capability to provide future forecasts.

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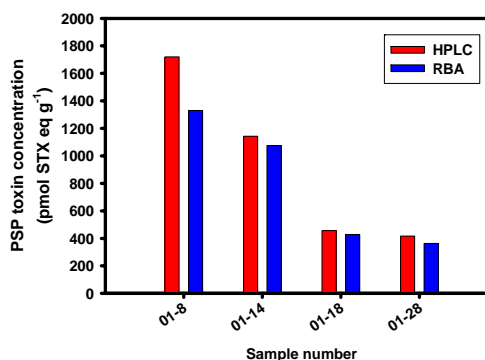
OBJECTIVES OF RESEARCH ACTIVITIES: To elucidate and characterize the pathways and efficiency of algal toxin trophic transfer in marine food webs.

DESCRIPTION OF RESEARCH ACTIVITIES: Algal toxins are well-known to undergo trophic transfer and accumulation in marine food webs, causing intoxication of upper-level consumers such as fish, sea birds, and marine mammals, including those species that are classified as protected and endangered. However, in many cases the vectors responsible for transferring these toxins from their algal producers to higher trophic levels, and thus the primary routes of toxin movement in a given food web, have not been established. Complementary toxin detection techniques, including receptor binding assays, high performance liquid chromatography, and LC-MS/MS, are being used to identify toxin vectors and trace routes of algal toxin transfer in several marine food webs. In addition, estimates of algal cellular toxicity in field populations are being generated in order to better understand how the distribution of toxin among algal cells affects the efficiency of toxin entry into the food web. Such information will ultimately contribute to efforts aimed at modeling and predicting toxin trophic transfer in a given system. Our studies have focused primarily on two toxin classes, the saxitoxins and domoic acid, as they occur in coastal waters of Maine, central California, the Louisiana shelf in the Gulf of Mexico, and the Benguela region off South Africa.

Graphic/Image/Figures



Photograph of north Atlantic right whale mother and calf.
Photo by C. Slay, New England Aquarium



Graph demonstrating presence of PSP toxin in four right whale fecal samples as determined by receptor binding assay and HPLC

Selected Highlights

The following are several important findings from work conducted in 2002:

- Saxitoxins were detected for the first time in north Atlantic right whales feeding in the Bay of Fundy, Canada, suggesting that further studies are warranted to examine the possible role of these toxins in the reproductive failure of this highly endangered species.
- Populations of krill off the California coast were found to contain domoic acid, thereby establishing this crustacean as a potential vector for transfer of this toxin to its predators, including squid, baleen whales, and seabirds.
- The presence of saxitoxins in cultured and wild abalone from the west coast of South Africa was confirmed, representing a threat to the export and marketing of this valuable product.

Publications/Reports:

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Bargu, S., Powell, C.L., Coale, S.L., Busman, M., Doucette, G.J., & Silver, M.J. 2002. Krill: a potential vector for domoic acid in marine food webs. *Marine Ecology Progress Series* 237:209-216.

Presentations:

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J.T. Turner, **G.J. Doucette**, C.L. Powell, B.M. Keafer, and D.M. Anderson. Accumulation of PSP toxins in zooplankton size fractions during red tide blooms in Casco Bay, Gulf of Maine, April-June, 1998. ASLO/Ocean Sciences Meeting, 2002. Honolulu, HI.

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Doucette, G.J., R.M. Rolland, T.V.N. Cole, A.D. Cembella, J.L. Martin, L.A. Hollen, and A. Anderson. Evidence for the occurrence of PSP toxins in north Atlantic right whales (*Eubalaena glacialis*) and their zooplankton prey in the Bay of Fundy, Canada. Xth International Conference on Harmful Algae, 2002. St. Petersburg, FL

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